

such as calcitic and dolomitic limestone raise soil pH. A high pH can cause many other problems such as making some nutrients unavailable to plants. If calcium is low but a pH change is undesirable, gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) can be incorporated into the soil prior to planting. A soil test is the best way to make fertilizer applications most cost-efficient.

**Magnesium** may be deficient, especially in low pH soils. If magnesium levels and soil pH are low, dolomitic limestone can be used to raise the pH and supply the needed magnesium. To add magnesium without affecting the pH, Epsom salts ( $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ ) can be applied, either as a soil incorporation or as a soil drench. A soil incorporation of granular Epsom salts is the method of choice for application during bed preparation, while a soil drench with an Epsom salt solution is used if magnesium is needed and plants are already in place. If magnesium is needed, the general rate for Epsom salts is 10 lbs per 1000 ft<sup>2</sup> of bed area for dry application or 4 lbs per 100 gallons of water for a soil drench applied at 250 gallons per 1000 ft<sup>2</sup> of bed area (1 quart per square foot of bed area).

The soil **pH** for bedding plants should be between 5.5 and 6.5. An approximate pH can be

**Table 2. Approximate amount of ground limestone needed to increase the pH of the upper 7 inches of 5 soil types to 6.5.**

Soil texture (upper 7 inches)	pH Range			
	4.5 to 4.9	5.0 to 5.4	5.5 to 5.9	6.0 to 6.4
	Lime to apply (lbs/1000 square feet)			
Sand	115	92	69	23
Loamy sand	138	115	92	46
Sandy loam	184	138	115	69
Clay loam and loam	230	184	138	92
Clay and silty clay	270	230	184	92

Lime recommendations are based on using a ground limestone with a neutralizing value of 90%.

determined on site by using a portable pH meter. Mix one volume of soil with two volumes of distilled water, stir, allow to stand for 30 minutes, then read the pH. As with soil testing for fertilizer needs, amendments to improve aeration and/or drainage should be applied prior to testing soil pH. Table 2 presents some approximate amounts of ground limestone needed to increase the pH of five soil types. These values are only representative and should not be taken as recommendations. Limestone should be incorporated into the upper 7 inches of the bed for effective pH adjustment. If the pH must be lowered, elemental sulfur can be incorporated into the soil (Table 3). If only a small decrease in pH is required, acid-forming fertilizers such as ammonium nitrate can be used as a nitrogen source (Table 4).

**Table 3. Approximate amount of ground sulfur needed to decrease the pH of the soil to 6.5.**

Soil texture	pH Range			
	7.0 to 7.5	7.6 to 8.0	8.1 to 8.5	8.6 to 9.0
	Sulfur to apply (lb/1000 square feet)			
Sandy soils	9–13	22–34	34–45	45–68
Clay soils	18–22	34–45	34–45	---

Sulfur recommendations are based on using a ground sulfur material containing 95% S.

**Potassium** can be surface applied, if needed. If soil test results are not available, then a rule of thumb is to apply 1 to 3 lbs  $\text{K}_2\text{O}$  per 1000 ft<sup>2</sup>. However, it is possible to over apply potassium which can lead to deficiencies of other nutrients, particularly magnesium. To apply 1 to 3 lbs  $\text{K}_2\text{O}$ , use 1.7 to 5 lbs of muriate of potash (potassium chloride), 2.3 to 6.8 lbs of potassium nitrate, or 2.1 to 6.3 lbs of potassium sulfate per 1000 ft<sup>2</sup>. Muriate of potash has a salt index of 114 which is very high and should be used with caution.